

ABRAMS MODERNIZATION: KEEPING THE BEST AHEAD OF THE REST

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Introduction

The M1 Abrams tank system has represented a significant portion of the Army's combat power on the battlefield since its introduction in the early 1980s. Proven in the Persian Gulf War, the system continues to fulfill its role as the principal armored combat weapon system of the Army's armor units. Although recent initiatives have resulted in lighter Army forces, the Abrams system is expected to remain in the force structure for the foreseeable future, with some projections showing its service to 2030 and beyond.

The challenge, then, is to keep the Abrams fleet in top form by maximizing combat effectiveness as efficiently as possible. Specifically, this means making the best use of available research and development (R&D) and operations and support (O&S) dollars. The only way this can be accomplished is to develop an effective modernization strategy that includes the best investment mix for upgrading, retrofitting, and overhauling Abrams tank resources. This article presents a snapshot of the Abrams Modernization Program by discussing the ongoing range of initiatives designed to maintain the technological "edge" the Abrams has achieved on the battlefield.

Modernization Initiatives

As mentioned, the Abrams modernization strategy incorporates three project thrusts: upgrades, retrofits, and overhauls. The upgrade thrust targets the conversion of obsolescent M1 Basic vehicles, most built in the early 1980s, into the latest version—the M1A2 System Enhancement Package (SEP). This is the most radical conversion and consumes the most resources in terms of time and dollars. The second thrust is the retrofit of M1A2 systems into the fully digitized M1A2 SEP configuration. The third thrust is the overhaul of the M1A1 system into a digitized and more capable version of the M1A1

called M1A1+. This latter, far-reaching effort is dubbed the Abrams Integrated Management (AIM) Program. AIM is essential for modernizing the M1A1, the tank that encompasses the bulk of the fielded systems.

In addition to the initiatives designed to systematically upgrade, retrofit, and overhaul Abrams tank systems, programs are underway to recapitalize subsystems that outfit all tank systems. These efforts are aimed at reducing costs for repair and replacement of major spares. For example, the existing Abrams AGT 1500 engine has been a significant O&S cost driver for the Abrams fleet. An ongoing two-phased effort is designed to improve the engine performance in both the short- and long-term. Electronic obsolescence of the increasingly digital components presents a continuing challenge as the special purpose electronic components age. Modular electronic componentry is now an essential modernization feature to simplify electronic upgrades and lower costs.

The results of the recapitalization effort benefit each of the tank modernization strategies by providing more cost-efficient subsystems, which will eventually drive down the O&S costs for maintaining the Abrams fleet. Recapitalization also positions the Abrams as a stiff competitor for foreign military sales opportunities and for development of tank-variant vehicles. These investment strategies are described below in more detail.

M1 Basic To M1A2 SEP

Today, M1A2 SEP production begins with the induction of M1 Basic vehicles at the Anniston Army Depot (ANAD) in Alabama. The vehicle turret and hull are disjoined and disassembled. The components scheduled for reuse are inspected, repaired, and refurbished. Components are then reassembled and shipped to the Lima Army Tank Plant (LATP), Lima, OH, where the M1A2 SEP vehicles are completed in accordance with the upgraded Technical Design Package.

Figure 1 depicts the scope of major improvements made to the M1 to upgrade to the M1A2 SEP. The process calls for installation of a new turret that includes all new wiring harnesses, armor, weaponry, and electronic componentry with a digital data bus. The hull, while less significantly overhauled, is modified with appropriate engine and transmission rebuilds and integrated with new and improved track and suspension components. One of the final steps is integrating the new turret and the rebuilt hull. Following the government's acceptance, the new M1A2 SEP vehicle, with a new serial number and the traditional "new-car smell," is issued to the field.

The M1 Basic to M1A2 SEP conversion is the most extensive and costly modernization innovation ever made to the Abrams fleet. Unfortunately, only a portion of the fleet will be upgraded under this process. Current investment funds allow only about 20 percent of the required tank fleet to be upgraded to the M1A2 SEP configuration. Thus, it represents only one portion, albeit a very significant one, of the Abrams modernization effort.

M1A2 To M1A2 SEP

The major improvements originally made to the M1A2 were the addition of a second battle sighting system (which allowed the commander to select targets independent of the gunner), a driver's steer-to-control display, and the first built-in test diagnostics system fielded on a tank. The M1A2 SEP included these improvements and many more such as second generation forward looking infrared (FLIR), the Army's objective command and control (C2) system, the Global Positioning System, an auxiliary power supply system, crew thermal management, color tactical displays, and signature management. The M1A2 SEP is the first true digital system and maintains signal and computer processing with room for future growth.

Because approximately 620 M1A2 systems were initially produced and fielded prior to the approval of the SEP modernized system, it became necessary to retrofit the original M1A2s to the SEP configuration. Many of the changes are simple module swap-outs, but a number of the changes need reconfiguration of mounts and cabling to satisfy the retrofit to the SEP configuration. The majority of these involve the integration of digital C2, power supply modules, and communication devices added by SEP. The program goal is to bring all M1A2 vehicles to a common SEP capability and physical configuration.

One of the most basic challenges in the retrofit program is maintaining a pure fleet in

fielded units. A staggered schedule of M1A2 turn-ins and M1A2 SEP issues has been devised covering a period of nearly 4 years to ensure units are fielded as unit sets. In addition, the schedule complements the production of “new” M1A2 SEPs from basic M1s (as mentioned above). A mixed strategy of upgrade and retrofit is necessary because there is insufficient funding to go the pure upgrade route and insufficient retrofit assets to achieve the end-state objective quantity of M1A2 SEP systems.

AIM

The majority of fielded M1 Abrams (about 4,500 vehicles) are the M1A1 type. Most of these systems were built in the 1985-1993 timeframe. As such, they incorporate the analog technology of the early 1980s. Unfortunately, analog technology is no longer state-of-the-art in the digital age of

the 21st century. The AIM Program is the innovative concept developed to systematically overhaul the M1A1 to the more capable M1A1+.

The AIM Program does not incorporate enhanced systems that provide the battle overmatch features of the M1A2 SEP Program. Instead, the program focuses on overall improvements in system readiness and features an innovative teaming concept between ANAD and the Abrams tank’s prime contractor, General Dynamics Land Systems (GDLS). The goal of this teaming effort is to overhaul the M1A1 to factory standards and to apply, at one time, all accumulated modification work orders (MWOs).

Similar to what was described in the M1A2 to M1A2 SEP upgrade process, ANAD personnel take inducted M1A1 vehicles and clean, inspect, and disassemble chassis and turret components. Additionally,

they perform restoration operations and apply selected technological components (Figure 2). GDLS personnel at LATP facilities collaborate further in applying MWOs to the turret and hull. These personnel also complete required system tests and final preparations for shipment. While the finished tank is in a “like-new” condition when issued back to the field, it still operates with 1980s analog technology. The prime benefit of the overhaul program is its effectiveness in applying high-payoff recapitalization projects at a greatly reduced cost when compared to field retrofit of MWOs.

Recapitalization Initiatives

One of the most significant of the high-payoff recapitalization projects is the search for an improved Abrams engine. While the AGT 1500 engine represents late 1960s technology and approximately 12,200 engines

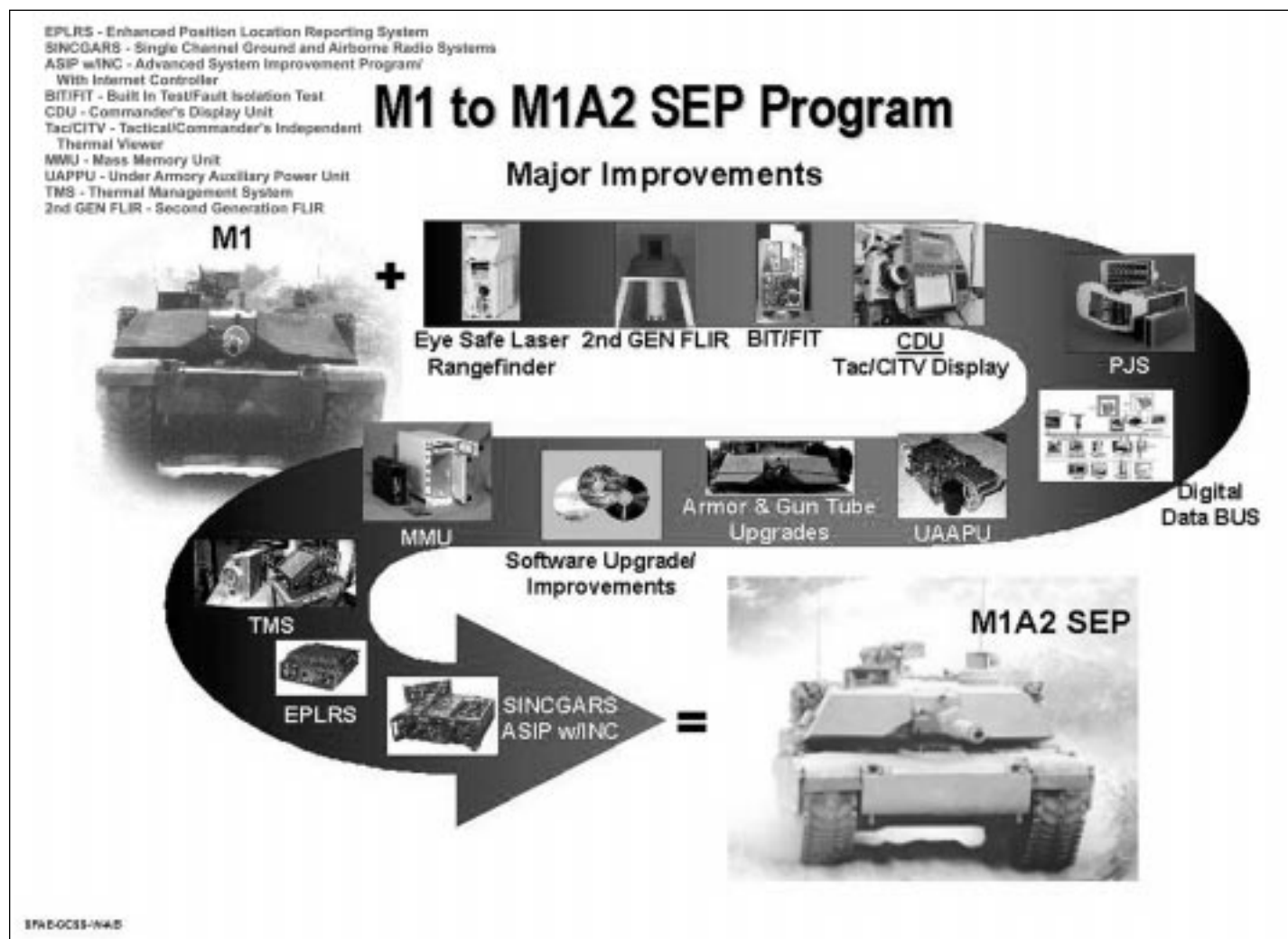


Figure 1.

AIM Program

Overhaul + Applied Improvements



Figure 2.

have been built, none have been produced since 1992. Today, all replacement engines, even those in the M1A2/AIM Programs, are overhauled engines that incorporate several reliability and durability improvements. However, program results have not shown significantly improved Mean Time Between Repair (MTBR) rates. Consequently, the engine is the biggest single cost driver, representing approximately 60 percent of the Abrams' O&S costs.

The engine recapitalization program is two phased. The first, called PROSE (Partnership to Reduce Operation and Support Costs, Engine), is a partnership among Honeywell, GDLS, and the Program Manager (PM), Abrams Tank System. This phase is designed to establish best-commercial practices, reduce multiple buyers, and consolidate engine overhaul operations, field service, and sustainment management. The second phase is a major initiative to "repower" the Abrams tank. A number of technological improvements have been made that show promise for

reducing fuel consumption, reducing moving parts and power-pack size, improving mobility, and increasing MTBR. Collectively, these enhancements suggest multiple options for engine improvements that are under investigation.

The engine represents a prime recapitalization effort that would benefit all the M1 variants, but other initiatives are also under consideration in the Abrams Modernization Program. These include constant efforts to reduce the costly effects of electronic obsolescence through the use of modular, plug-in components, and improved diagnostics and prognostics to simplify repair and logistical support considerations.

Conclusion

The Abrams tank provides the mobile protected firepower demanded by soldiers on the battlefield. As such, its modernization is critical to maintaining high operational capability and overmatch over potential threat systems. The Abrams tank system's recapitalization efforts and similar concepts are

now being considered for other combat systems. Abrams continues to be an example for other fleets to emulate in an era of declining resources. The goal of PM, Abrams Tank System is to seek the most cost-effective integration of upgrade, retrofit, overhaul, and recapitalization strategies that will allow the Abrams to remain in the forefront of the U.S. Army's armored capability.

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